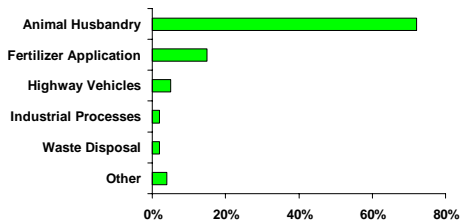


Preparation of Fine Particulate Emissions Inventories

Chapter 8 – Ammonia Emissions from Animal Husbandry



NH₃ – Precursor to Ammonium Sulfate & Nitrate (National Emissions ~ 4.8 M TPY)



8-2

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Update to Ammonia from Animal Husbandry is Timely

- **Inverse modeling** suggests overestimation of ammonia.
- Shortcomings of old NEI
 - Probable errors in emission factor selections, especially for beef.
 - Does not use information on variability of emissions due to different manure handling practices within a given animal industry.
 - Does not make total use of information of available National Agricultural Statistics Service (NASS) data on different animal populations, by average live weight.

8-3

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Update to Ammonia from Animal Husbandry is Timely (Cont'd)

- **Effluent Guidelines** project provided information on production & waste handling practices (new).
- **National Academy of Science (NAS)** committee recommended a long data gathering effort.
 - **Old NEI estimates** are not the best we can do in the interim (while this data gathering is undertaken).

8-4

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Improved Basis for Interim NEI Update

- Provides improved data on populations, practices, and emissions.
- Allows a switchover to a process-based framework that is common, transparent and that allows partial updating as more data becomes available.
- Motivates and provide structure for relevant data collection.
- Opportunity to educate users about data limitations, proper use.
- Goal: Higher animal production States will begin to adopt / offer improvements to new method.

8-5

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Overview of New Estimation Methodology

- Step 1: Estimate average annual animal populations by animal group, state, and county.
- Step 2: Identify Manure Management Trains (MMT) used by each animal group and then estimate the distribution of the animal population using each MMT.
- Step 3: Estimate the amount of nitrogen excreted from the animals using each type of MMT, using general manure characteristics.

8-6

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Overview of New Estimation Methodology (Cont'd)

- Step 4: Identify or develop emission factors for each component of each MMT.
- Step 5: Estimate ammonia emissions from each animal group by MMT and county for 2002.
- Step 6: Estimate future ammonia emissions for years 2010, 2015, 2020, and 2030.

8-7

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Step 1: Population Estimates

- Animals: Dairy, beef, swine, and poultry.
 - Keep weight groups & animal types distinct.
- State-level population: 2002 NASS.
- County apportionment: using 1997 Census of Agriculture.
 - Privacy Issue - Where state and/or county is not disclosed, divide equally.

8-8

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Step 2: Manure Management Trains

- 15 MMT's plus permutations (similar to "model farms" used in past approaches).
 - e.g., Housing, waste storage, land application type.
 - Non-feedlot outdoor confinement (e.g. pasture) is one of the trains for swine, dairy, and beef.
 - MMT's represent different pathways for escape of ammonia to the air.
 - MMT "mix" varies by state, not within a State.
 - Another "opportunity" for improvement

8-9

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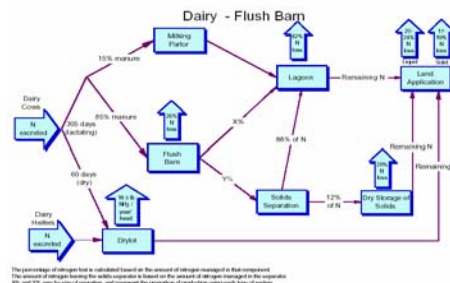
Step 2: Manure Management Trains (Cont'd)

- Animal population, etc. is allocated among the applicable trains.
- Note: Final stage in each train is land application.

8-10

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Advanced Example of Manure Management Train



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Step 3: Nitrogen Excreted

- Typical animal weights (within a type and weight range)
- Nitrogen per 1000 kg of live weight from NRCS *Agricultural Waste Management Field Handbook*
- Local agriculture experts could help improve this
 - Land Grant University Researchers / Extension Agents

8-12

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Step 4: Emission Factors

- Select the emission factor for each stage of each manure management train.
 - Some are lb/animal, some are percent air release of input ammonia.
 - Both kinds also determine ammonia transferred to next stage.
- Air emissions can never be higher than original manure content.
- Using stage-specific emission factors sets the stage for applying temporal profiles and process-related variability later.

8-13

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Step 5: Apply for 2002

- Track ammonia release through each manure management train for each animal type, calculating air releases and transfers to next stage.
- Assumes no air emission controls at this time.
 - But can add control assumptions later, and see downstream consequences.
- Emissions are summed up to animal type and county
- Database is preserved with full detail for transparency and later revisions.

8-14

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Step 6: Future Years Projections

- 2010, 2013, 2020, and 2030.
- USDA and Food and Agricultural Policy Research Institute.
- Accounts for past observed cyclical populations.
- State-by-state population pattern.
 - Changes with time for dairy.
 - Fixed for others.

8-15

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Comparison of 1999 and 2002 Ammonia NEIs

Animal Group ⁰	1999 NEI			2002 NEI		
	Population	Emission Factor lb/head /yr	Emissions Tons/year	Population	Emission Factor lb/head /yr	Emissions Tons/year
Cattle and Calves Composite	100,126,106	50.5	2,476,333	100,939,728	23.90	1,205,493
Hogs and Pigs Composite	63,095,955	20.3	640,100	59,978,850	14.32	429,468
Poultry and Chickens Composite	1,754,482,225	0.394	345,325	2,201,945,253	0.60	664,238
Total	1,917,704,286	N/A	3,461,758	2,362,863,831	N/A	2,299,199

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Ongoing Additional Improvements

- Plan to incorporate emission estimates for sheep, ducks, goats, and horses.
- Looking at more recent manure production and excretion rates by animal types and weight (may provide lower overall estimates than currently indicated in draft report).
- Looking into ways to better address spatial, seasonal, and regional differences in emissions.

8-17

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CMU Model and the NEI

- Carnegie Mellon University (CMU) has prepared a model for estimating ammonia emissions from agricultural activities, humans, wastewater treatment, wildfires, domestic and wild animals, transportation sources, industrial activities, and soils.
- Includes an improved methodology for fertilizer application when compared to the methodology used in previous versions of the NEI.
- EPA is evaluating the methodologies used for other source categories in the CMU model.

8-18

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